CODE A VIDEO GAME CREATE CRAFTS CONDUCT SCIENCE EXPERIMENTS DISCOVER FACTS

FOR CURIOUS YOUNG MINDS 8 TO 14

Brainspace

A SMART & INTERACTIVE MAGAZINE

SUSTAINABLE BEESWAX CRAFTS

NAMING A SHARK

Learn the meaning in a shark's name

LOVE MATH

Play a calculating game with dice

LOST CITY

Discover Roman history in Pompeii

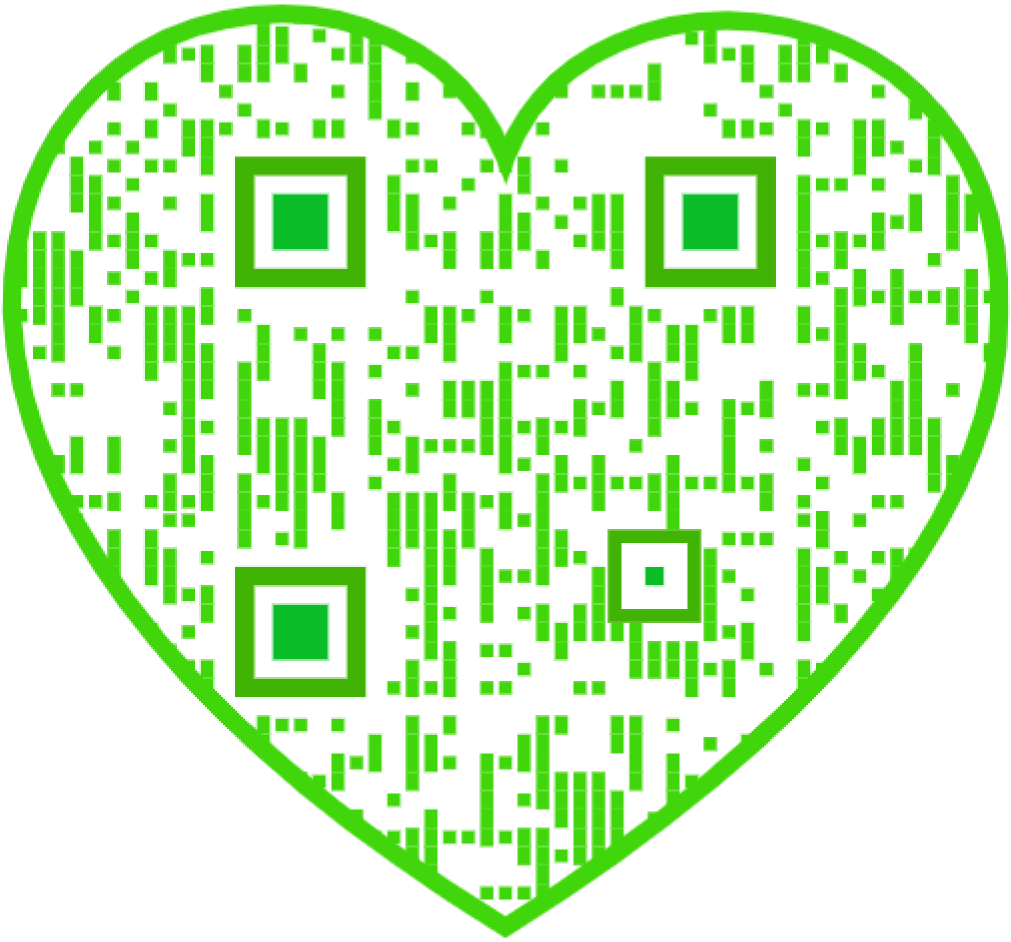
THE SCIENCE OF SPIT

Find out why saliva is super!

GIRL POWER

Why clownfish and other animals prefer female leaders

APRIL/MAY 2025



HOW TO make this magazine interactive:

Download the free Zappar app on your mobile device.

1. **Look for these codes:**
2. **Launch Zappar.**
3. **Scan page with mobile device. Watch and enjoy!**

TRY 6 BRAIN-BENDING SCIENCE EXPERIMENTS!
Brainspace
FOR CURIOUS YOUNG MINDS 8 TO 14
FANTASTIC FACTS ABOUT
OWLS
LAUNCH THE FREE ZAPPAR APP ON ANY MOBILE DEVICE AND SCAN ME NOW TO HEAR WHAT I'VE GOT TO TELL YOU!
YOUR MORPHING BONES
3 EASY COSTUMES YOU CAN MAKE
THE SCIENCE OF FEAR (AND LAUGHTER)
FALL 2022 $8.95

AT HOME IN SPACE • STORMY SCIENCE • MAKE A TUBULAR INSTUMENT
Brainspace
INTERACTIVE ACADEMIC FUN FOR KIDS 8-14
DINOS LIVE AMONG US!
DISCOVERY HAS PALEONTOLOGISTS ALL AFLUTTER
SCAN WITH ZAPPAR TO WATCH THIS COVER COME TO LIFE!
TREES FILTER WATER
TINY BUT MIGHTY!
THEY BUG US BUT WE NEED THEM
BIG MEG!
THE MYSTERIOUS MEGALODON
SUMMER 2022 $8.95

EDITING
HOLLY BENNETT

COPY EDITING
COLLETTE YVONNE

FACT-CHECKING
JAN KERTESZ

CONTRIBUTING WRITERS
HOLLY BENNETT
PASCALE BIDER
LEO CHAN GASKINS
JAN KERTESZ
BEN MAYCOCK
NICOLE MEYERS
ALEX MIDDLETON
JESSICA ROSE
WILL SAUNDERS

ART DIRECTION
GALEXY STUDIO

ORIGINAL MUSIC SCORES
ALEX MIDDLETON

SOCIAL MEDIA & VIDEO
GABRIELLE MIDDLETON

PUBLISHER
Brainspace Publishing Inc.

PRESIDENT
Nicole Middleton

SEO WEB DESIGN
Herbert Leamus

ACCOUNTING SERVICES
Leah Witherspoon

Brainspace magazine is published six times a year: February, April, June, August, October and December

Brainspace Publishing Inc.,
394 Ontario Street,
Newmarket, ON L3Y 2K4

PHONE (905) 830-4314
Toll-free (844) 330-4314

EMAIL
info@brainspacemagazine.com

SITE
brainspacemagazine.com

Periodical postage paid at Canada Post, Ontario, Canada.

POSTMASTER:
Send address changes to
Brainspace Publishing Inc.
394 Ontario Street,
Newmarket, ON L3Y 2K4

SUBSCRIPTIONS
Canada $35 • US $50 • International $90
Bulk rates for schools and libraries available
Prices are subject to taxes and shipping rates

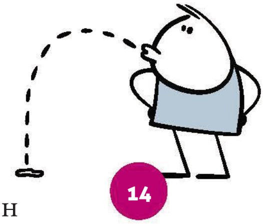
ISSN 2291-8930
If you would like to contribute to ***Brainspace*** magazine, please email info@brainspacemagazine.com

MISSION
Brainspace magazine produces intelligent and engaging articles for students ages 8 to 14 in a format that bridges the gap between print and digital technology to expand literacy and promote optimal learning.

NOTE The opinions expressed herein are those of the respective authors and not necessarily those of ***Brainspace*** magazine or of Brainspace Publishing Inc. ***Brainspace*** magazine and Brainspace Publishing Inc. will not be liable for any damages or losses, howsoever sustained, as a result of the reliance on or use by a reader or any other person of any of the information, opinions or products expressed, advertised or otherwise contained herein. Where appropriate, professional advice should be sought.

Funded by the Government of Canada | Canada

4 math 33 TO 99 MATH DICE GAME
5 coding CODE YOUR OWN VIDEO GAME
8 environment BEWARE THE FATBERG!
10 zoology FEMALE LEADERS OF THE PACK
12 science FANTASTIC FIVE WOMEN IN SCIENCE
14 biology THE SCIENCE OF SPIT
16 chemistry DIATOMS
18 technology SWELL SHELLS
20 history POMPEII
22 history INSIDE A ROMAN BATH
24 craft BEESWAX GIFTS
26 botany POLLINATOR PARADISE
28 biology WILD MEDICINE
30 language SHARK ETYMOLOGY
34 space WHERE DID THE MOON COME FROM?
36 chemistry TALLULAH
38 make it SUSTAINABLE GIFTS



contents

33 to 99

IF YOU ENJOY A GOOD NUMBERS CHALLENGE, THIS GAME IS FOR YOU

YOU WILL NEED:

- 5 dice
- 2 or more players
- paper and pencils for each player
- a timer (optional)

OBJECT OF THE GAME:

Get as close to the target number as possible

HOW TO WIN:

Lowest score takes all

RULES:

1. Pick a leader. This changes for each round. The leader calls out a target number between 33 and 99, then rolls the 5 dice.

2. If everyone is comfortable with a timer, start it to begin a round! (We recommend no less than 2 minutes and no more than 5 minutes per round.)

3. All numbers on the dice must be used in the equation to reach the target number. You can use multiplication, addition, subtraction and division. Parentheses are allowed.

For example:

- 34 is the target number
- roll of dice: 6, 2, 1, 1, 4, 6

6 x 6 + 2(1) – 4(1) = 34

4. Time's up. Your score is the difference between the number and the target.

For example:

- your calculation is 36 - your score is 2

or

- your calculation is 32 - your score is 0

No negatives!

5. Compare the results. The score that is closest to the number wins the round.

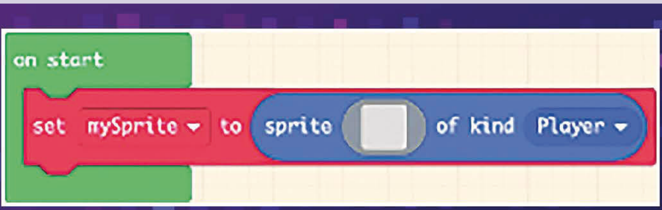
6. Play until each player has a turn to call the target number and roll the dice.

CODE YOUR OWN

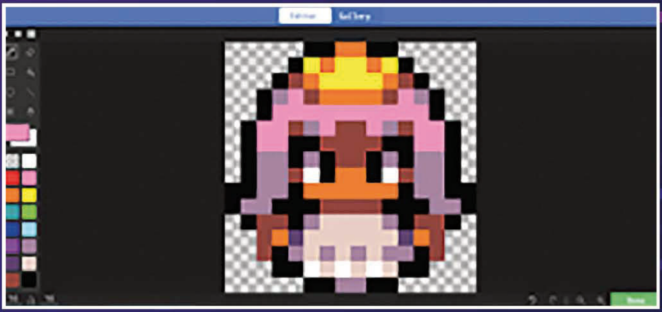
VIDEO GAME DESIGN

How do the video games you love to play get designed? Let's learn by creating a video game. Go to MakeCode Arcade by Microsoft at arcade.makecode.com, click "new project" and let's get started!

BY NICOLE MEYERS



```
on start
    set mySprite ▾ to sprite ☐ of kind Player ▾
```



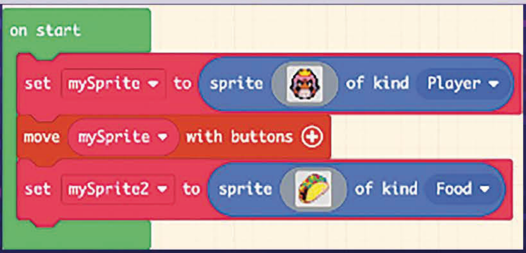
1 We are going to make a very simple chase game called "Taco Tuesday." You will have two "sprites" (aka characters): your main player and the taco you are trying to catch!

In the blue Sprites menu, drag the "set my sprite" block into the "on start" block already on your workspace to create your player character. Click the grey oval to open up the sprite editor and select "gallery" to find a player sprite you like! Click "done" and your main character should appear in the middle of your screen.

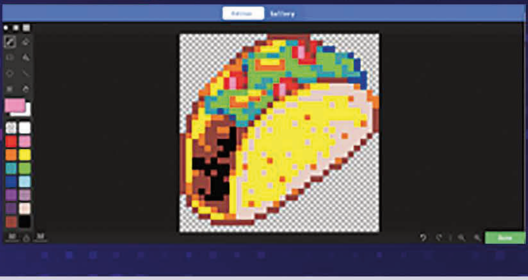
2

In the orange Controller menu, drag in a “move mySprite with buttons” block and place it after the first block we created. This will allow us to move our player!

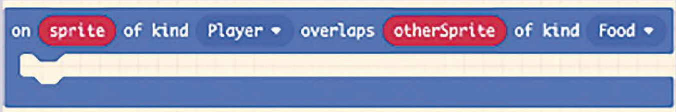
Go back to the Blue sprites menu and drag in another “set my sprite” block so that it comes after the orange move block. Click on “of kind player” and change it to “food.” This will be the taco we are trying to catch! Click on the grey oval to open up the sprite editor and select “gallery” to find the taco sprite.



```
on start
  set mySprite ▾ to sprite [ ] of kind Player ▾
  move mySprite ▾ with buttons ⊕
  set mySprite2 ▾ to sprite [ ] of kind Food ▾
```



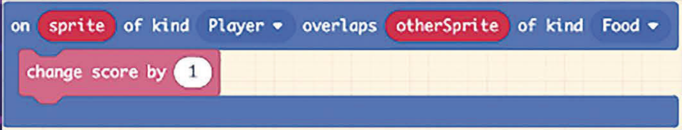
3



```
on sprite of kind Player ▾ overlaps otherSprite of kind Food ▾
```

Go back to the blue Sprites menu; this time click and drag in an “on sprite overlaps other sprite” block. This should go OUTSIDE of your green "on start" block. Keep the first sprite kind as “player” and change the second sprite kind to “food.”

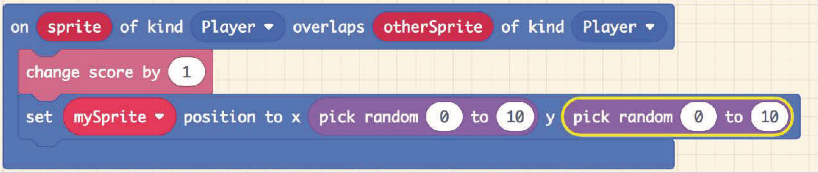
4



```
on sprite of kind Player ▾ overlaps otherSprite of kind Food ▾
  change score by 1
```

Head into the pink “Info” menu and drag a “change score by 1” into this block. Now, when your player “catches” the taco, their score will go up by 1!

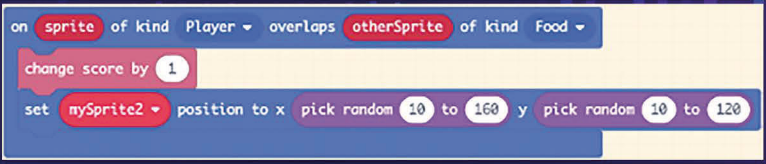
5



```
on sprite of kind Player ▾ overlaps otherSprite of kind Player ▾
  change score by 1
  set mySprite ▾ position to x pick random 0 to 10 y pick random 0 to 10
```

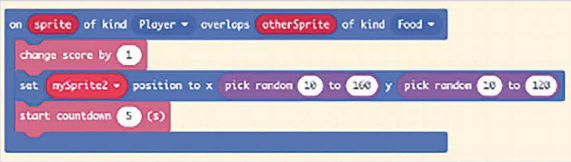
We don’t want our taco to be in the same place all the time; that would make the game too easy! We can tell our taco to move to a random position on our screen by going into the blue Sprites menu and dragging out a “set position to x y” block AFTER our “change score” block. Be sure to change this block to say mySprite2 so it is applying to your taco sprite.

6 Then, open the purple Math menu and drag out 2 “pick random” blocks. Drop one block into the white space for the x coordinate that currently says 0, and another into the y coordinate. Change the numbers for the x coordinate to be between 10 and 160. Change the numbers for the y coordinate to be between 10 and 120.



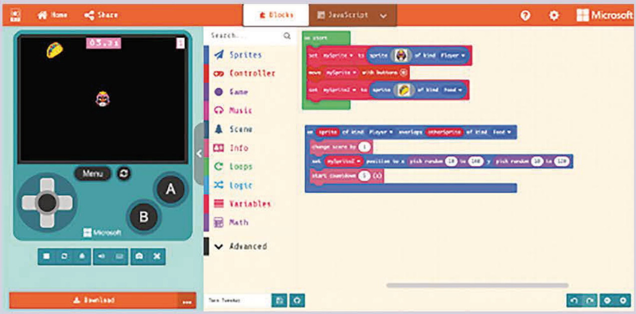
```
on sprite of kind Player ▾ overlaps otherSprite of kind Food ▾
    change score by 1
    set mySprite2 ▾ position to x pick random 10 to 160 y pick random 10 to 120
```

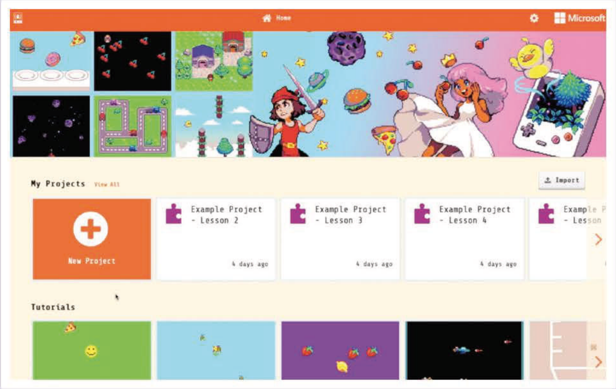
7 Last but not least, let’s add a timer to our game to make it a bit more challenging! In the pink "Info" menu, drag out a “start countdown” block and add it after you set your sprite’s position. The shorter the time, the harder the game! Around 5 seconds is a good starting place.



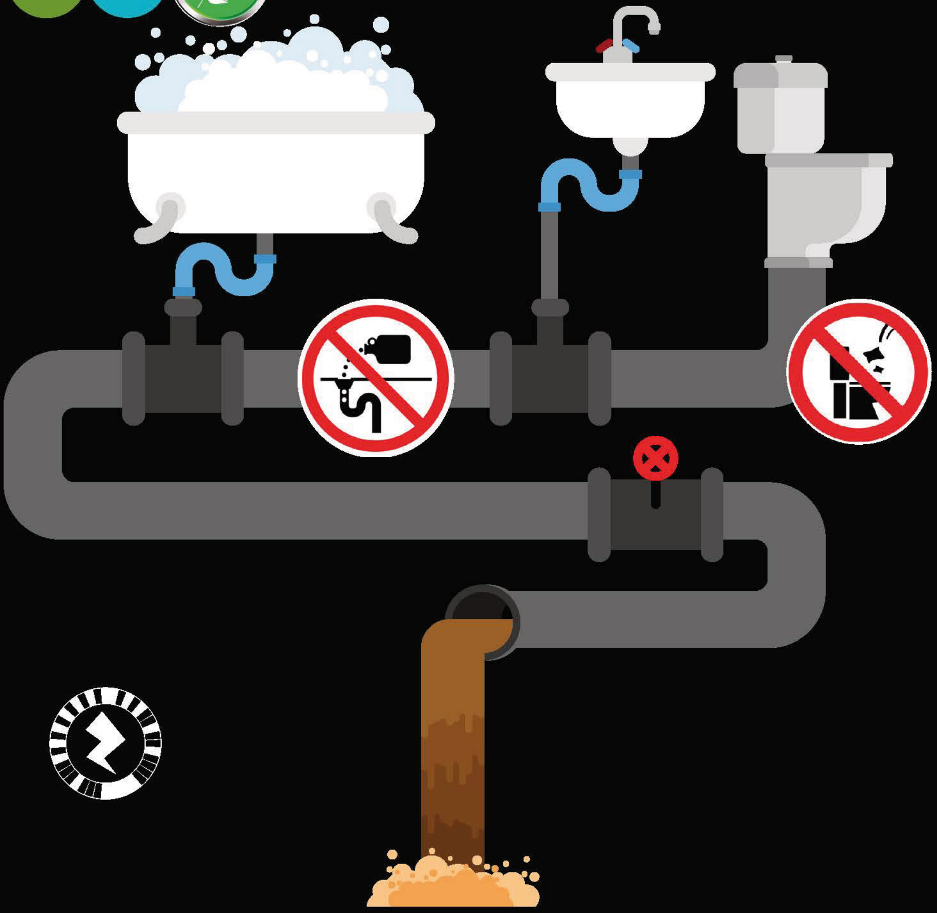
```
on sprite of kind Player ▾ overlaps otherSprite of kind Food ▾
    change score by 1
    set mySprite2 ▾ position to x pick random 10 to 160 y pick random 10 to 120
    start countdown 5 (s)
```

Awesome work! You can use the game simulator on the left of your screen to test your game. Use the arrow keys on your keyboard to control your player. If you run out of time before you collect your taco, you’ll get a "game over" screen that shows your high score.


Home
Share
Blocks
JavaScript
Microsoft
Search...
Sprites
Controller
Game
Music
Scene
Info
Loops
Logic
Variables
Math
Advanced
Menu
A
B
Download


Home
Microsoft
My Projects
View All
Import
New Project
Example Project - Lesson 2
4 days ago
Example Project - Lesson 3
4 days ago
Example Project - Lesson 4
4 days ago
Tutorials

LAUNCH ZAPPAR TO WATCH A STEP-BY-STEP DEMONSTRATION BY STEM MINDS.
stemminds.com



BEWARE THE FATBERG!

By Holly Bennett

IT GREW IN THE SEWERS OF LONDON, ENGLAND. It smelled like a rotting corpse. And it was huge and as heavy as a blue whale: 130 tonnes (286,600 pounds) and 250 metres (820 feet) long!

It sounds like something from a horror movie, and it was horrific alright. But it wasn't some alien/mutant creature lurking in the pipes – it was a fatberg. And there are lots more of them. In fact, fatbergs are a costly problem for municipal sewage systems everywhere.

What is a Fatberg?

A fatberg forms from things people shouldn't (but do) flush down the toilet (such as baby wipes and paper towels) and wash down the drain (grease and oil). The wipes, which don't disintegrate like toilet paper, can snag on a rough place or bend in the sewer. The grease coats it and solidifies. As the buildup grows, it snags more and more of these materials as they flow through the sewer, and the whole mass hardens over time until it's like a greasy block of concrete.

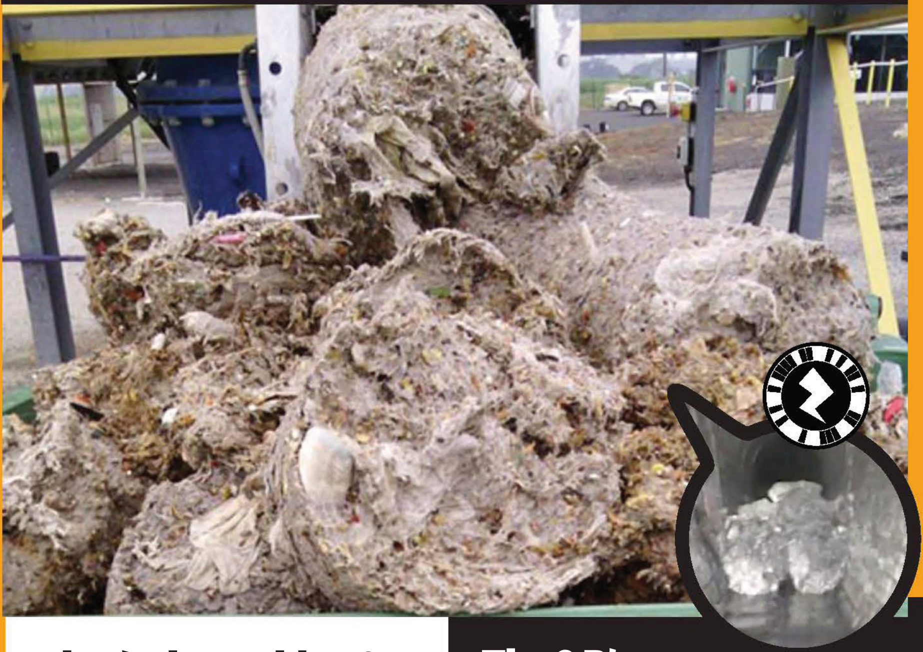


PHOTO: HUNTER WATER

What's the Problem?

Fatbergs eventually clog the pipes and cause big problems:

- **raw sewage backing up into people's homes**
- **water outages**
- **damage to water treatment equipment**
- **higher utility rates for all residents to cover the cost of removal and repairs**

It takes months of work and millions of dollars to remove large fatbergs from sewer systems.

The 3 P's: Pee, Poo, and Paper

The solution is simple: don't pour grease down the sink, and don't flush anything but pee, poo, and toilet paper. No, not even "flushable" wipes or tissues! They might go down your toilet, but they don't break down properly in the sewer. Wipe small amounts of cooking oil from the pan with a paper towel and pour larger amounts into a container. Freeze it, and put it in the trash on garbage pick-up day. Your pipes will thank you!

FEMALE LEADERS OF THE PACK

BY JAN KERTESZ

Matriarchy is a term used to describe a social system governed by a female. Roughly 10% of mammal species that live in social groups are led by a dominant female (matriarch). Some female leaders govern by force and aggression, while others lead by teaching and transferring knowledge.

Guess whether the matriarchs in groups of naked mole-rats, ring-tailed lemurs, clownfish and African savanna elephants lead by force or by teaching. Continue reading to see if you guessed correctly!

NAKED MOLE-RATS

These rodents live underground in groups as large as 300. The queen is the only female in the colony who produces offspring. Although she cares for her babies in a gentle manner, the queen naked mole-rat uses force and her large size to bully adult members of her colony.

Researchers believe that the queen's use of aggression is so overbearing that it causes constant stress on other female naked mole-rats and suppresses their ability to produce offspring.

The queen's spine gets longer each time she is pregnant. This lengthening allows her body to hold larger litter sizes as she ages. A young queen usually delivers a litter of 10 babies, while an older queen can have up to 30 babies each time!

RING-TAILED LEMUR

The ring-tailed lemur is named for the 13 alternating black and white bands on its tail.

A troop of ring-tailed lemurs consists of up to 30 members. They are monomorphic, meaning females and males look similar with few distinguishing features.

Despite being the same size as her troop members, the female leader governs by force and keeps her members in check by biting and slapping. These bullying tactics ensure the matriarch gets first access to food and shelter so she remains strong and can protect the troop from enemies.

CLOWNFISH

In a clownfish social group, a single large female lives with 6 or 7 smaller males. Despite being outnumbered, the female clownfish is highly aggressive and interacts with males forcefully. This dominant behaviour includes controlling their movement and limiting their access to food.

If the female clownfish dies, the way in which she is replaced might surprise you. The largest male in the group immediately assumes the aggressive leadership position, but his evolution doesn't stop there. He begins a physical transformation that turns him into a female clownfish and, after about a year, she can produce offspring.

Clownfish can communicate with each other through popping and clicking sounds.

AFRICAN SAVANNA ELEPHANTS

The matriarch in a clan of African savanna elephants is usually the oldest and most experienced female in the group. She uses her intelligence and exceptional memory to ensure the safety of the several hundred elephants in her clan. Her commitment to leading by example and sharing wisdom helps prepare other females in the clan who may eventually take her place as matriarch.

The African savanna elephant is the largest land animal on the planet and consumes about 136 kilograms (300 pounds) of vegetation daily.

FANTASTIC FIVE

Game-Changing Discoveries by Women Scientists

BY HOLLY BENNETT

In the past, women interested in science did not have an easy road! In some cases, science education was not considered “suitable” for women. Sometimes it was hard for them to get hired or publish their findings. Despite these odds, there have been many females throughout history who made huge contributions to science. Take this quiz, and use the Zappar app to scan each photo for the answers and learn more about these five science superstars.

ASTRONOMY

1. JOCELYN BELL BURNELL

Burnell was a graduate student when she discovered the existence of a dense, rapidly spinning neutron star. What is this kind of star called?

BIOCHEMISTRY

2. ROSALIND FRANKLIN

Franklin used a technique called X-ray crystallography to take the very first photograph of this “mystery molecule” that carries the genetic code of all living things.

photo credits: Jocelyn Bell Burnell By Roger W Haworth - Flickr, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=37003823 Rosalind Franklin https://www.britannica.com/biography/Rosalind-Franklin

PALEONTOLOGY

3. MARY ANNING

Though entirely self-taught, Mary Anning was one of the most important fossil finders of the early 1800s. She discovered the first nearly complete skeleton of an ichthyosaur – a marine reptile – which scientists first thought must be fake because of its “impossibly long neck.”

PHYSICS

4. LENE HAU

How do you stop something that travels 300,000 km (186,000 miles) per second? Most scientists thought it was impossible, but Danish physicist Lene Hau discovered a way to slow down, and even stop, something we thought must always travel at a constant speed. What was it?

MEDICINE

5. ALICE BALL

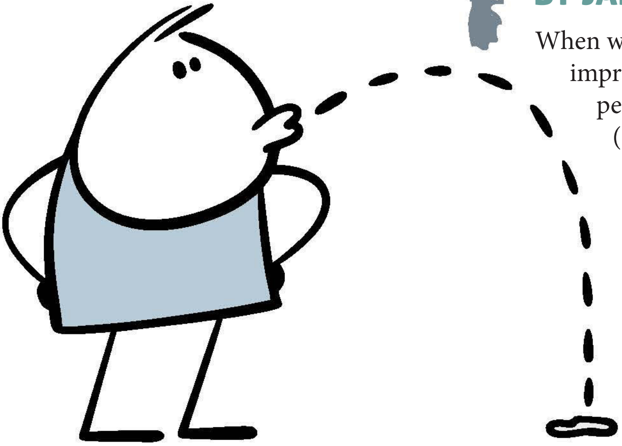
Alice Ball was only 23 years old when she developed the first effective treatment for this disease that had been feared since ancient times. Before that, people who caught the disease were sent to isolated communities where they had to stay until they died, so her work changed a lot of lives for the better!

Mary Anning “Mr. Grey” in Crispin Tickell’s book *Mary Anning of Lyme Regis* (1996) **Lene Hau** Photo courtesy of Justin Ide/ Harvard News Office - https://www.wpafb.af.mil/News/Photos/igphoto/2000631932 Public Domain, https://commons.wikimedia.org/w/index.php?curid=23881324 **Alice Ball** Unknown - http://www.hawaii.edu/offices/bor/distinction.php?person=ball, Public Domain, https://commons.wikimedia.org/w/index.php?curid=10635615

BIOLOGY

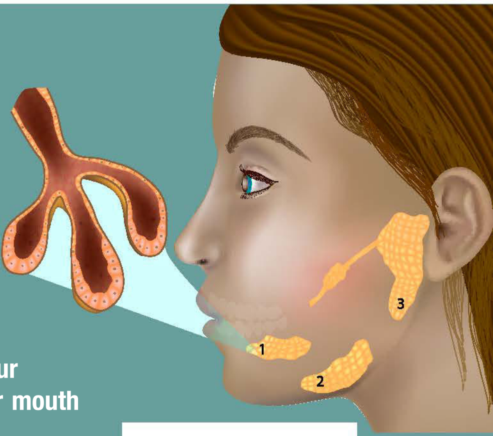
THE SCIENCE OF Spit

BY JAN KERTESZ



When we think of the many impressive functions our bodies perform each day, saliva (spit) production probably doesn't come to mind. Yet without saliva, the simple act of swallowing would be nearly impossible. Let's learn more about this powerful (and underappreciated) fluid.

How DO WE PRODUCE SALIVA?



SALIVARY GLANDS
1. SUBLINGUAL
2. SUBMANDIBULAR
3. PAROTID

Three major pairs of salivary glands produce saliva, which enters our mouth through small openings called ducts.

SUBLINGUAL GLANDS are deep in the floor of our mouth on either side of our tongue. Saliva from these glands enters our mouth through many tiny ducts.

SUBMANDIBULAR GLANDS are under our jaw, and the saliva they produce enters our mouth through ducts below our tongue.

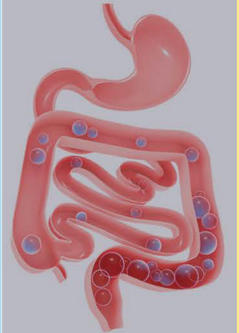
PAROTID GLANDS are the largest salivary glands and are in front of our ears. The saliva produced here enters our mouth through ducts near our top molars.

We also have hundreds of minor salivary glands under the lining of our mouth and throat. These small but mighty glands create more saliva than our 6 major salivary glands combined.

Why DO WE PRODUCE SALIVA?

ORAL HEALTH
Saliva fights cavities, canker sores and gum disease by washing away food debris, diluting harmful acids, and shielding our mouth from bacteria. Calcium hydroxyapatite in saliva prevents calcium loss and tooth enamel erosion.

GERM FIGHTING
Saliva provides a lubrication barrier over the mucus membranes in our mouth to help guard against bacteria and toxins. Antiviral and antimicrobial compounds in saliva work to destroy harmful pathogens.



DIGESTION
Saliva contains enzymes called amylase and lingual lipase that help us digest and absorb nutrients. Amylase breaks down starches into sugar, and lingual lipase breaks down fats. (Our body also produces lipase in our pancreas and stomach.)

WOUND HEALING
Have you ever bitten your tongue or the inside of your cheek? Histatin, a protein in saliva, kills bacteria and prompts cells to migrate over wounds to promote fast healing. This explains why many animals lick their wounds.

The Power OF SALIVA

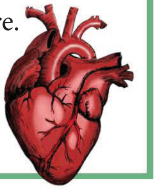
Have you ever noticed that flat soda pop (containing little or no carbonation) tastes sweeter than fizzy soda pop? Scientists believed that acidic carbon dioxide bubbles in soda pop distract our brain from tasting the sweetness in the beverage. New research shows this is not the case.

Saliva is responsible for the taste variation. When we drink a carbonated beverage, saliva prevents bubbles from flowing freely in our mouths. These trapped bubbles block sugar from reaching our taste receptors.

We produce up to 2 litres (8 cups) of saliva each day.

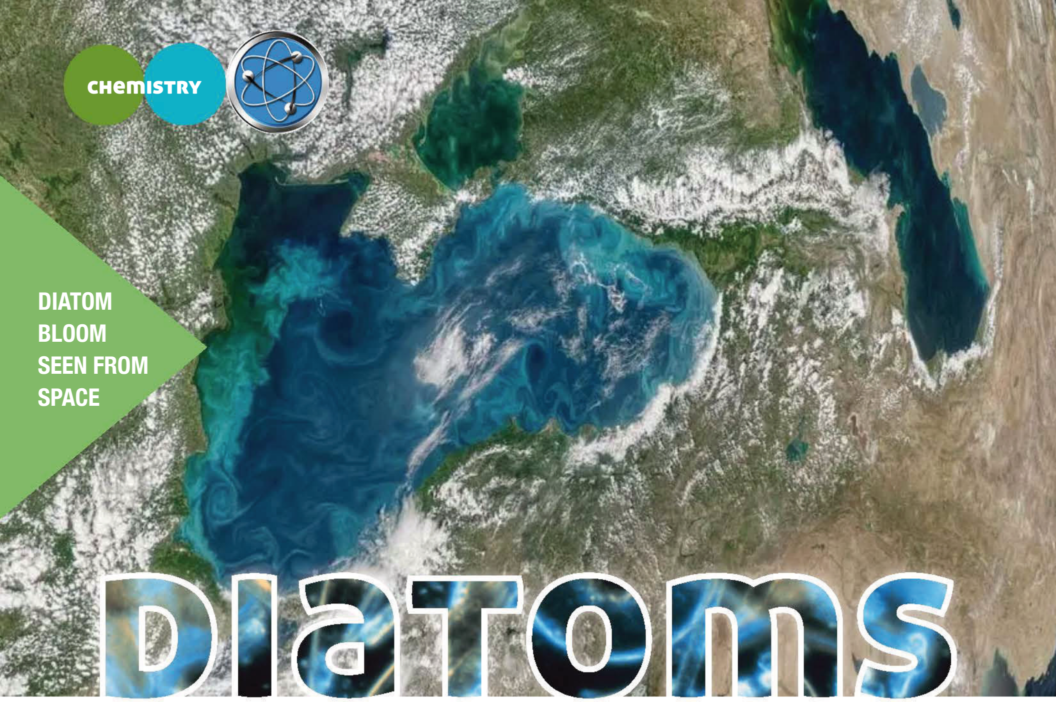
Saliva is roughly 99% water. Proteins, electrolytes and mucus make up the remaining 1%.

A single drop of saliva can be used to screen for diseases such as cancer and heart failure.



Dogs and cats have 4 pairs of major salivary glands. Mice have the same 3 pairs of salivary glands (parotid, submandibular and sublingual) as humans!

CHEMISTRY



DIATOM
BLOOM
SEEN FROM
SPACE

DIATOMS

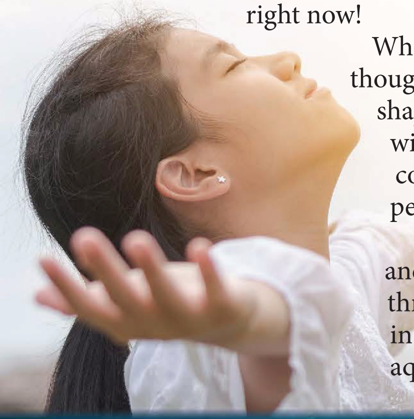
Smaller than the width of a human hair but visible to astronauts in outer space, the diatom may be one of the most awesome creatures you've never heard of!

BY BEN MAYCOCK

On the surface, the diatom may appear to be a relatively simple creature. But this single-celled organism has fascinated scientists for hundreds of years and may very well be responsible for the breath you are taking right now!

When diatoms were discovered in 1702, they were thought to be tiny animals, because the geometrically shaped organisms were observed swimming freely within their environment. Biologists eventually concluded that they were plants, because they performed photosynthesis.

We now know that diatoms are single-celled algae and are found in oceans, lakes, waterways and soils throughout the world. Their population numbers in the trillions and they can even be found in the aquarium in your home.



Diatoms produce between 20 and 40 percent of the air we breathe

FUN FACT: Admired for their beauty, diatoms have been used to create tiny art pieces since the 19th century.

CENTRALES AND PENNALES

Diatoms can be found in two basic forms. Wheel-shaped centrales are most often found on the surface of the ocean, while elongated pennales live in fresh water or on the ocean floor.

The diatom is the only organism on Earth that lives in a house made of glass. Its cell walls are composed of transparent, often colourful silica: a chemical compound of silicon and oxygen that is often used to make glass. These cell walls are decorated with stunning, detailed patterns, making them a feast for the eyes when observed under a microscope. And more than 25,000 species of diatoms have been found, none of which have the same shell.

SILICA SAND

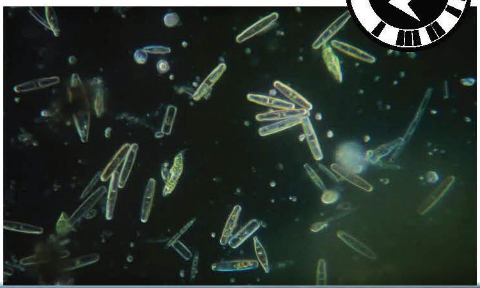
The diatom performs photosynthesis, meaning its light-absorbing molecules turn the energy from the sun into sugar, a process that releases oxygen. It has been estimated that about 20 to 40 percent of the oxygen we breathe is thanks to diatoms.

Diatoms and the health of our planet are interdependent. As the planet warms, scientists expect the number of larger marine plankton, such as diatoms, to decrease. Fewer diatoms ultimately means less oxygen being released, changing the chemistry of our atmosphere.

When conditions are right, a diatom population can explode, forming a massive bloom on the surface of the ocean that can only be seen from space. When astronauts see these beautiful swirling patterns on the surface of our planet, it is almost as if they are witnessing our planet breathing.

When diatoms die, their silica shells sink to the bottom of the body of water in which they lived. Thick layers of these deposits fossilize and turn into a substance called diatomite. Because of its porous nature, diatomite can be used to filter liquids such as water. Diatomite is also a mild abrasive, making it useful in such products as metal polish and toothpaste.

LAUNCH ZAPPAR TO WATCH



Fascinating fact: A scientist added water to diatoms that had been dried out for nearly 150 years and was amazed to see them immediately spring to life and swim about!

SWELL SHELLS

POLISH SCIENTISTS RELY ON NATURE TO SOUND THE ALARM ON WATER PURIFICATION PROBLEMS

BY BEN MAYCOCK

Unless you're a malacologist (a scientist who studies mollusks), it is unlikely you think much about clams. And to be fair, they aren't thinking much about you because they have no brains! Most of them simply live their lives buried beneath the sand and silt of both freshwater and saltwater rivers, lakes and oceans.

In Poland, however, there are eight types of clams that have been recruited to protect the citizens of Poznań. These small but mighty heroes make sure that the drinking water pumped through the city's pipes is clean and safe enough to drink.

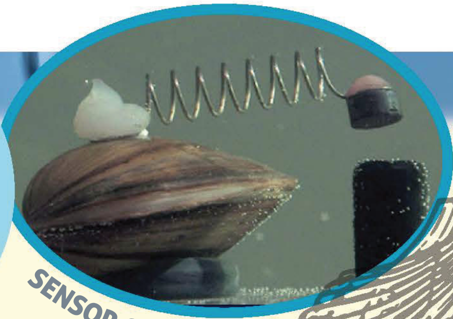
Poznań's main water source is the Warta River, a waterway that winds its way through areas where many people live, and much industry takes place. The high risk of pollution getting into the river threatens the cleanliness of the water people drink in Poznań.

To test how clean and pure the water is, scientists have come up with an ingenious way of combining both technology and nature to create a system that is extremely reliable.

On the technology side, water samples are taken and analyzed to detect chemical contamination. While these

UNSELFISH SHELLFISH

Over 50 water treatment plants in Poland rely on shellfish to keep water safe. So does Minneapolis, USA!


SENSOR ON CLAM

important tests identify particular chemicals, they take time to produce and react to changes in the water results.

But it is the nature side of the system that gives an accurate overall picture of the cleanliness of the water and reacts in an instant to stop any harmful water from reaching a drinking glass.

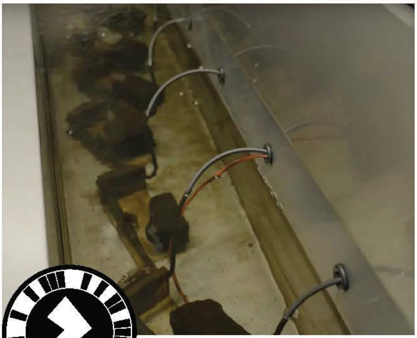
Clams need clean, well-oxygenated water with few physical or chemical impurities to live comfortably. When water is to their liking their shells are open so they can feed. They do this by filtering the water and eating any organic matter they find. But when the water quality drops, they quickly slam shut their shells. This makes them ideal guardians of the water supply!

The eight clams in the Poznań water filtration plant each have a sensor glued to their shell. When a shell shuts, a signal is sent to a computer. When four of the eight shells have shut, the computer turns off the water supply.

The clams and freshwater mussels used in this system are recruited from local rivers and lakes. They usually "work" at the plant for about three months. By then they have become accustomed to their surroundings and may not be sensitive enough to monitor the water. They are then returned to a habitat where they can live out their "retirement," safe from being caught again.

BLUEGILL FISH

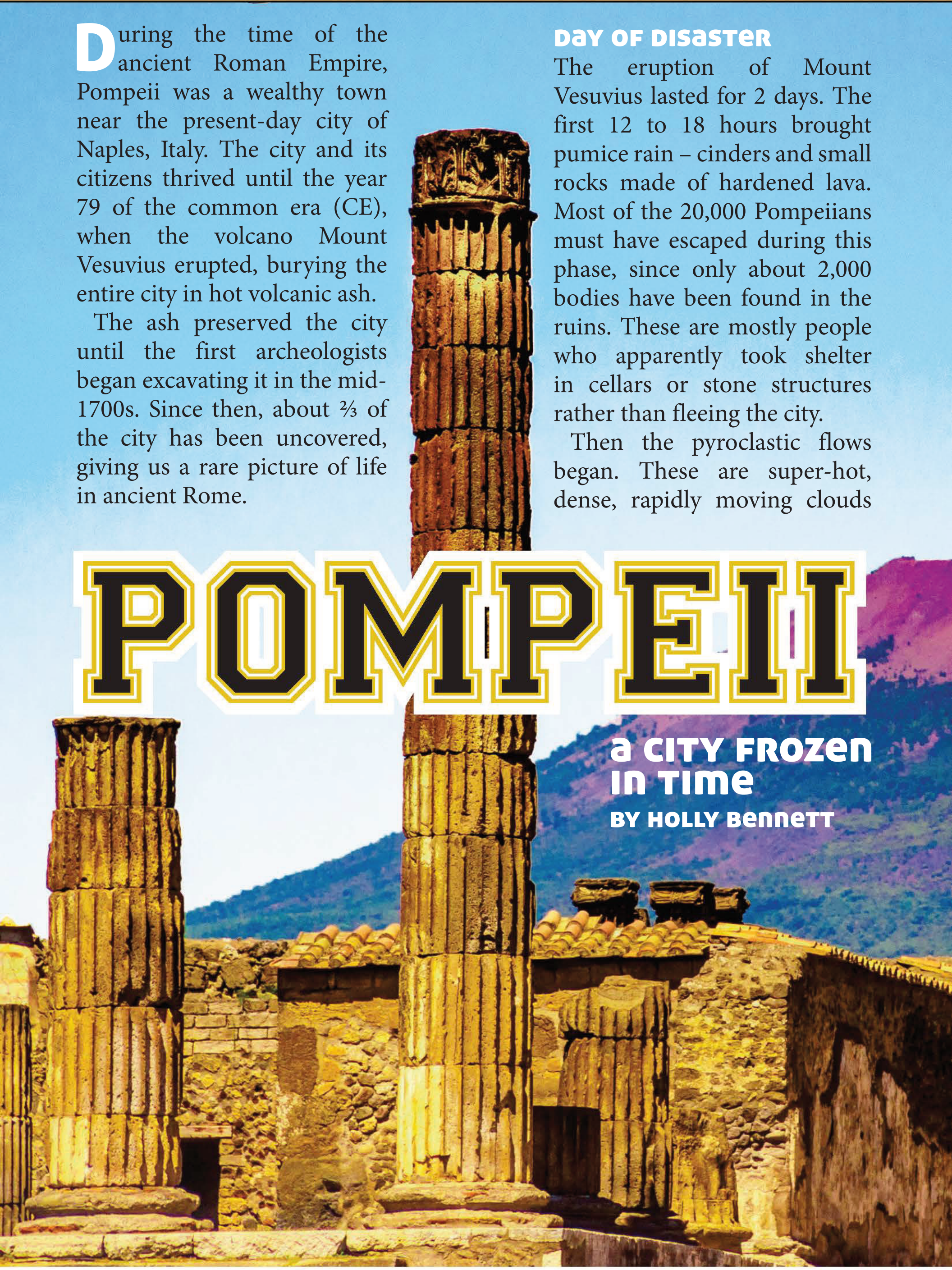
In San Francisco and New York City, bluegill fish are used to detect contamination in water. They will react to toxins by changing its breathing, swimming patterns, and coughing, indicating the water needs to be tested.


LAUNCH ZAPPAR TO WATCH

POMPEII

A CITY FROZEN IN TIME

BY HOLLY BENNETT



During the time of the ancient Roman Empire, Pompeii was a wealthy town near the present-day city of Naples, Italy. The city and its citizens thrived until the year 79 of the common era (CE), when the volcano Mount Vesuvius erupted, burying the entire city in hot volcanic ash.

The ash preserved the city until the first archeologists began excavating it in the mid-1700s. Since then, about ⅔ of the city has been uncovered, giving us a rare picture of life in ancient Rome.

DAY OF DISASTER

The eruption of Mount Vesuvius lasted for 2 days. The first 12 to 18 hours brought pumice rain – cinders and small rocks made of hardened lava. Most of the 20,000 Pompeiians must have escaped during this phase, since only about 2,000 bodies have been found in the ruins. These are mostly people who apparently took shelter in cellars or stone structures rather than fleeing the city.

Then the pyroclastic flows began. These are super-hot, dense, rapidly moving clouds

of volcanic ash, rock and toxic gas. Anyone still in town was killed by the extreme heat, suffocated, or crushed by collapsing buildings. By the end, the city was buried by 6 metres (19.7 feet) of ash and rubble.

What the ruins tell us about Roman life

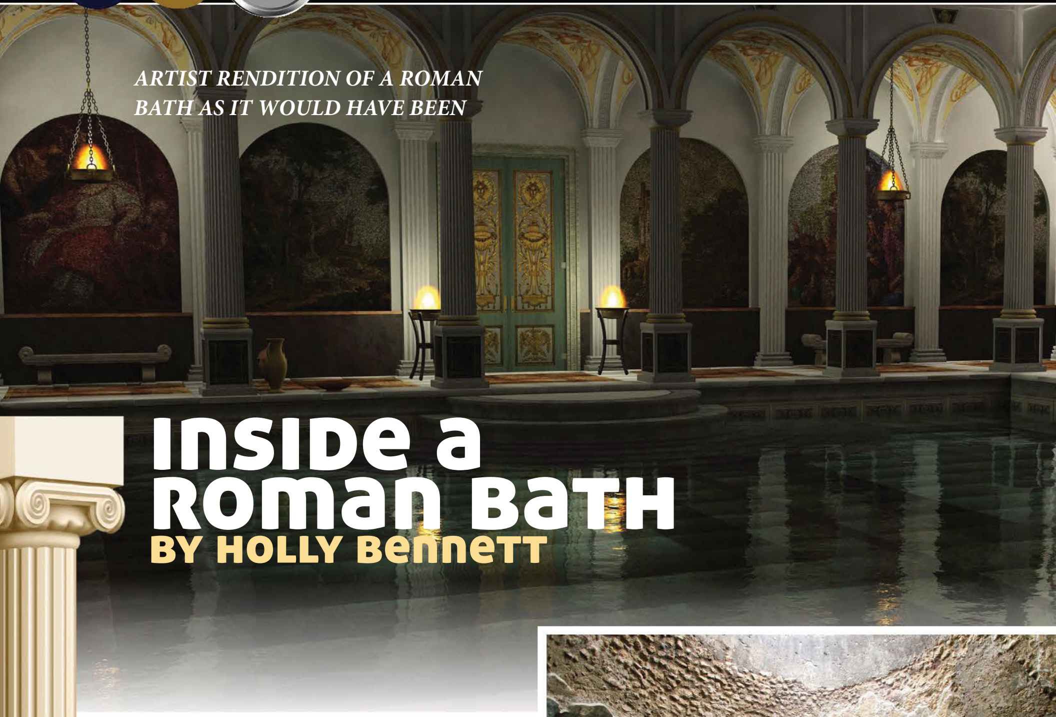
Because the city was mostly covered in loose material, not an actual lava flow that hardened into solid stone, it is mostly undamaged.

There are fine public buildings, fountains, and luxurious private homes with running water, rich decorations and artwork, and even personal jewellery. There are also basic homes, inns, workshops, shops and markets for different trades such as wool processing and baking. A workshop for making garum, a kind of fermented fish sauce, still contained sealed containers of the sauce itself! One restaurant has frescoes (wall paintings) of the food available, as well as an image of a dog with a collar and leash that might have been a reminder to customers to leash their pets. Some of the buildings even have graffiti on the walls, including political messages and dirty jokes of that time!

Preserving Pompeii

For 2,000 years, the ash kept out moisture and weather, effectively preserving the remains of the city. But since people first started excavating Pompeii, the exposed materials have been affected by weathering, erosion, light, vandalism and the wear and tear caused by tourists. The town is so big that only the most interesting and important buildings have been protected from the weather. There is real concern that much of Pompeii is deteriorating.

Today, most work on Pompeii is focused on preserving and restoring the site rather than excavating more of it.



ARTIST RENDITION OF A ROMAN BATH AS IT WOULD HAVE BEEN

INSIDE A ROMAN BATH

BY HOLLY BENNETT

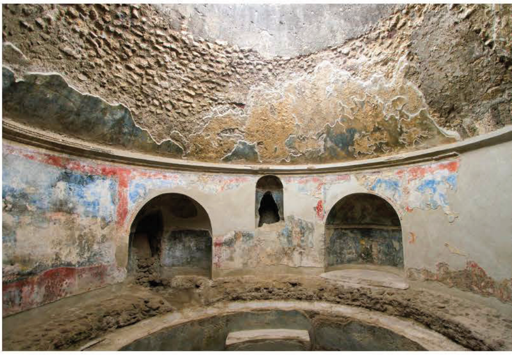
We might think a bath or shower should be a private event, but the recent excavation of an elaborate bathhouse in Pompeii shows that for wealthy ancient Romans, bathing was also a social activity.

Are you picturing one small room? Forget that! This bathhouse, which is part of a very large, grand house, had 4 separate rooms and was big enough to host up to 30 guests. Only the richest people in Pompeii had their own bath complex; most people used public bathhouses.

A FOUR-ROOM BATH

Guests would first undress in a change room with red walls and a marble mosaic floor.

Then they would go to the hot room to take a dip in a hot bath and lounge in the sauna-like heat.



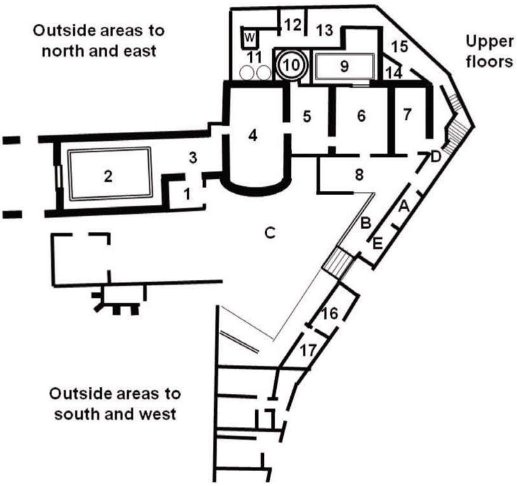
Excavated Roman bath in Pompeii.

Next came the warm room. Here they had oil rubbed into their skin and then scraped off with a gadget called a strigil, leaving them shiny clean.

Last but not least, the most amazing room of all – the cold room. There they could cool off and share refreshments in a deep pool big enough to hold a crowd, surrounded by red col-

Roman Bath

1: Anteroom
2: Pool
3: Room with heated floor
4: Calidarium (hot room)
5: Tepidarium (warm room)
6: Frigidarium (cold room)
7: Apodyterium (room for undressing)
8: Vestibule
9: Nymphaeum (cascading fountain and pool)
10: Laconicum (sweating room)
11: Praefurnium (furnace room)
12: Service room
13: Service room
14: Latrine a
15: Rear corridor
16: Outside shop or room
17: Outside shop or room
A: Corridor
B: Entrance corridor
C: Courtyard
D: Corridor with stairs to upper floor
E: Corridor
W: Deep well


Outside areas to north and east
W
11
12
13
10
9
15
14
Upper floors
5
6
7
4
3
2
1
8
D
A
B
E
C
16
17
Outside areas to south and west

Bronze strigil used to scrape oil off skin

umns and frescoes of athletes.

The bathhouse is connected to a huge banquet room, but it's unclear whether guests enjoyed their feast before or after bathing. As you can see, bathing for the wealthiest Romans was about much more than just getting clean. It was a way of socializing, making political and business contacts, showing off your wealth, and having a spa day.

Rooms the Guests Didn't See

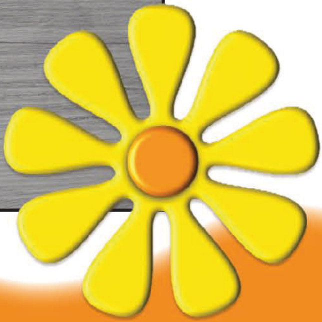
Where did all that heat and hot water come from? A pipe from the street brought cold water into the house. Some was sent to a boiler room just behind the hot room. There a furnace heated the water in the boiler, and slaves worked in unbearably hot conditions to feed the furnace and keep everything working.

Pompeii shows us that some Romans led a life of complete luxury, but this life was only made possible by slaves whose lives were very hard.

BEESWAX GIFTS TO MAKE

JUST Bee-cause

by ALEX MIDDLETON



Beeswax FOOD WRAP

YOU'LL NEED:

- Beeswax (pellets)
- 100% cotton fabric (size can vary)
- Scissors
- Medium-sized paintbrush
- Parchment paper
- Baking sheet
- Ruler

1. Choose what size beeswax food wraps you'd like to make. We recommend:
    a. **Small** (15 x 20 cm or 6 x 8 in): perfect for single pieces of fruit or other small snacks
    b. **Medium** (25 x 30 cm or 10 x 12 in): will cover a bowl or a block of cheese
    c. **Large** (40 x 40 cm or 16 x 16 in): will cover a large bowl or a sandwich
2. Cut your fabric to size. Draw a line using a ruler to keep things straight.
3. Preheat the oven to 200°F (93°C).
4. Line your baking sheet with parchment paper and then place your fabric on top. If your fabric only has a pattern on one side, put the pattern side face down.
5. Evenly distribute beeswax pellets all over your fabric.
6. Place your baking sheet in the oven until the pellets melt. This should take between 5 and 10 minutes. With the help of an adult, take the tray out of the oven.
7. Use your paintbrush to evenly spread the wax over your fabric. Don't wait too long! This only works when the beeswax is soft.
8. Let your food wrap dry. Hang it on a clothesline or a hanger.

Paper Straws

by ALEX MIDDLETON

Beeswax Paper Straws

You'll need:

- Patterned or coloured paper
- Clear beeswax
- Non-toxic glue
- Wooden dowel, chopstick or knitting needle
- Scissors
- Mason jar
- Pot of water
- Parchment paper

1. Cut your paper into strips that are approximately 4 cm (1.5 in.) wide and 30 cm (12 in.) long.
2. Put glue along one of the long edges of your patterned paper.
3. Place your chopstick, dowel or knitting needle on the bottom corner of your paper, opposite the glue. Slowly roll the paper into a tube shape using the dowel, chopstick, or knitting needle.
4. Once you've rolled the entire length of your paper, use a small dab of glue to hold the paper in place.
5. Pull the chopstick, dowel or knitting needle out of your paper tube.
6. Each end of your straw will likely be jagged or pointy. Use scissors to cut off these pointed edges so they are straight.
7. Repeat these steps until you've completed as many straws as you would like to make.
8. Heat a pot of water on the stove. Once the water has boiled, ask an adult to help you place a mason jar full of wax into the pot.
9. Once the wax has melted, dip one end of your straw into the wax to coat it. You can do this to multiple straws at one time or one after another. Then flip the straw over to seal the other side.
10. Let your straws dry on parchment paper before use. Wax will seal your straws so that they are waterproof.

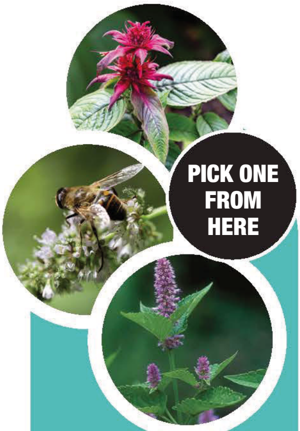
Create a

POLLINATOR PARADISE

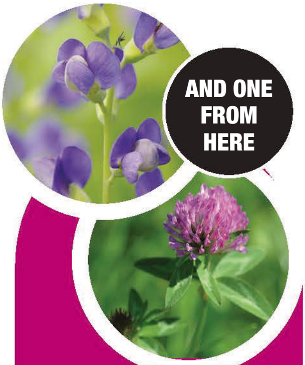
by Holly Bennett

Who are some of the most useful critters on the planet? Pollinator insects, that's who. They carry pollen on their bodies and move it between flowers. Without this pollination, ¾ of the world's flowering plants and almost 80% of the world's food crops wouldn't be able to set fruit or reproduce.

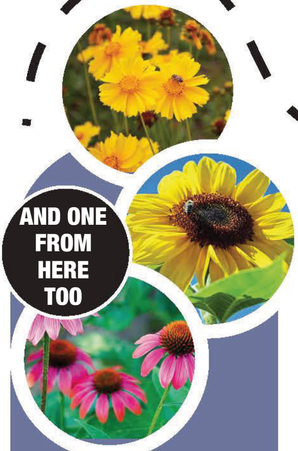
But insects, including pollinators, are declining in number. If you have a garden or a balcony with a planter box, you can help. Just plant pollinator-friendly flowers! Early spring is the perfect time for your family to plan a little pollinator paradise.



Plants from the mint family: wild bergamot, Virginia mountain mint, anise hyssop.



Plants from the pea family: false indigo, red clover. Other beautiful native pollinator plants include wild columbine, cardinal flower and blazing star.

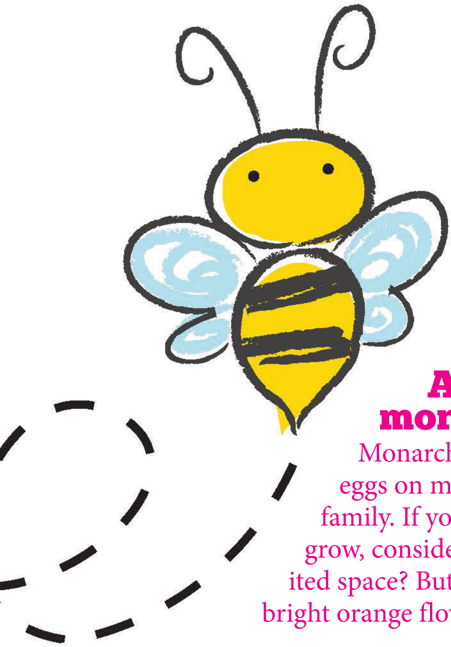


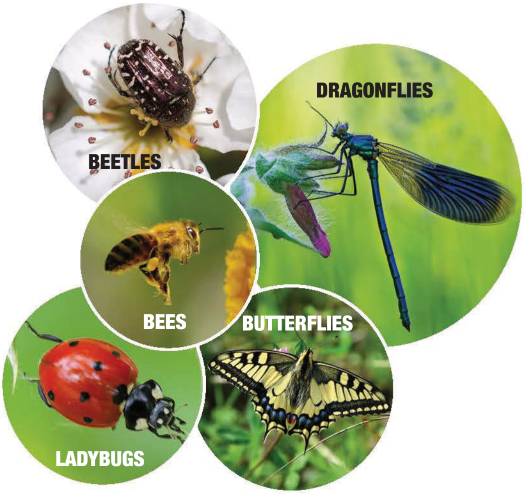
Plants from the daisy and sunflower family: coreopsis, black-eyed Susan, coneflower.

WHAT TO PLANT

THE MOST NUTRITIOUS PLANTS FOR POLLINATORS ARE OUR NATIVE WILDFLOWERS. LAURA RUSSO, A UNIVERSITY PROFESSOR WHO STUDIES POLLINATORS, SAYS THAT INCLUDING FLOWERS FROM 3 DIFFERENT FAMILIES WILL PROVIDE FOOD FOR A WIDE VARIETY OF POLLINATORS.

The pollinators





A feast fit for a monarch

Monarch butterflies only lay their eggs on members of the milkweed family. If you have lots of room to grow, consider a milkweed patch. Limited space? Butterfly weed has beautiful bright orange flowers and fits in anywhere.

In the spring, once there's no risk of frost, you can also plant a variety of pollinator-friendly annuals to make sure there are blossoms all summer.

Perennials: live for several years

Annuals: die in the winter

How to get them

1. Buy plants:

The easiest and fastest way to grow native perennials is to buy them at plant nurseries or farmer's markets in the spring. The cost adds up quickly though, so you might want to start with just a few plants.

2. Start seeds:

Here are some annuals that are easy to grow from seed: start them indoors in April or very early May, and plant them outside in June. They aren't native to Canada, but pollinators still love them:

Calendula

Marigolds
(look for the single, flat flowers, not the ones shaped like pompoms)

Nasturtiums

Zinnias

BIOLOGY

WILD medicine

BY PASCALE BIDER

When you get sick, you probably go to the doctor and take medicine. But what would you do if you were a monkey, a parrot, or a bee? Though animals in the wild may not have doctors and pharmacies, the world around them is full of medicine. Here are some of the things animals do to fight illness with nature.

POLLEN PILLS

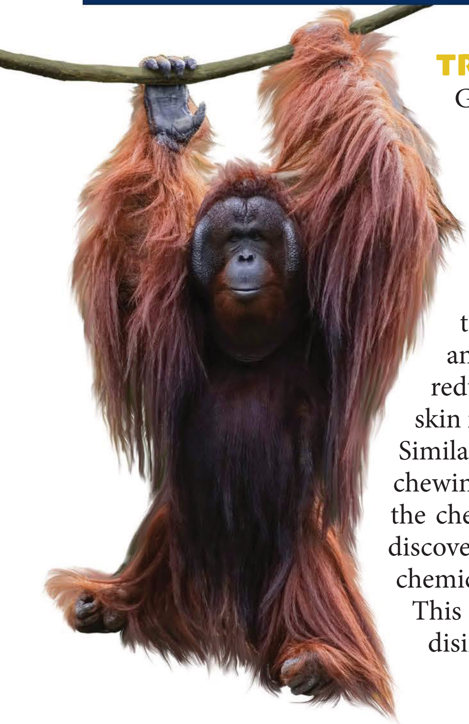
North American bumblebees often get sick from parasites. One of these, a microscopic organism called ***Crithidia bombi***, infects the bee's digestive system. This parasite makes it hard for the bee to collect food from flowers, so many infected bees don't survive. Luckily, bees have a superfood that prevents severe Crithidia infections: sunflower pollen! Many plants in the sunflower family have pollen grains covered with a spiky shell. These pollen grains contain many chemicals that may help get rid of parasites. Bumblebees that eat lots of sunflower pollen have way fewer ***Crithidia bombi*** infections. Planting native sunflowers is one way we humans can help keep our bees healthy!

MUNCHING FOR MEDS

Woolly bear caterpillars can also fall ill with a deadly parasite: tachinid flies. Fortunately, woolly bears can deal with this problem by munching the right stuff. When they become infected, the caterpillars will chomp down on large quantities of leaves from particular plants. These plants contain chemicals called pyrrolizidine alkaloids, which help caterpillars fight the infection. Woolly bears have to be careful: eating too many pyrrolizidine alkaloids can make them sick as well. Infected woolly bears eat way more of these chemicals, while healthy ones know to stay away. Like humans, woolly bears seem to know they should only take medicine when they're ill.

PARROT PRESCRIPTIONS

We humans wash our hands to avoid getting sick, and like us, birds have many grooming behaviours that help them stay healthy. Lots of nasty stuff can live in bird feathers. Bacteria, lice, mites, ticks, and fleas can damage feathers, suck blood, and cause disease. Many birds have glands that naturally produce something called "preen oil." This oil contains chemicals that can kill bacteria. Birds will spend a lot of time covering their feathers with preen oil, which kills the bacteria living there. Green parrots take this one step further. Some will chew up bark from pepper trees, then spread the chewed pulp through their feathers. Pepper tree bark contains many strong-smelling chemicals that repel insects and kill bacteria. Being covered in this stuff may give parrots more protection against bugs and germs!

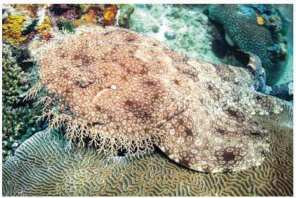


TREETOP TREATMENTS

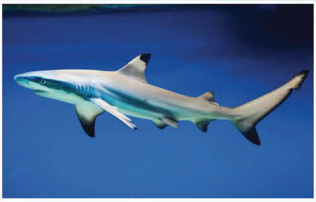
Great apes are also great doctors! Chimpanzees, gorillas, bonobos and many others will swallow whole leaves from fuzzy plants. Doing so seems to help them treat nematode infections in their guts. Orangutans in Borneo will chew leaves of specific plants into pulp, then massage this pulp into their arms and legs. The pulp contains chemicals that reduce pain and swelling, so rubbing it on the skin may help deal with monkey muscle aches. Similarly, an orangutan in Sumatra was spotted chewing up leaves of a liana plant, then using the chewed pulp to cover a cut. Scientists have discovered that the juice of the liana contains chemicals that kill bacteria and numb pain. This ape may have been using liana pulp as a disinfectant and a bandage!

SHARK ETYMOLOGY

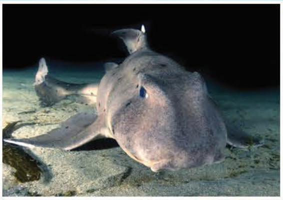
BY LEO CHAN GASKINS



TASSELLED WOBBEGONG SHARK
(Eucrossorhinus dasypogon)
eu = good
krossoi = tassel
rhinos = nose
dasys = hairy
pogon = beard
Meaning:
GOOD TASSEL HAIRY BEARD NOSE!



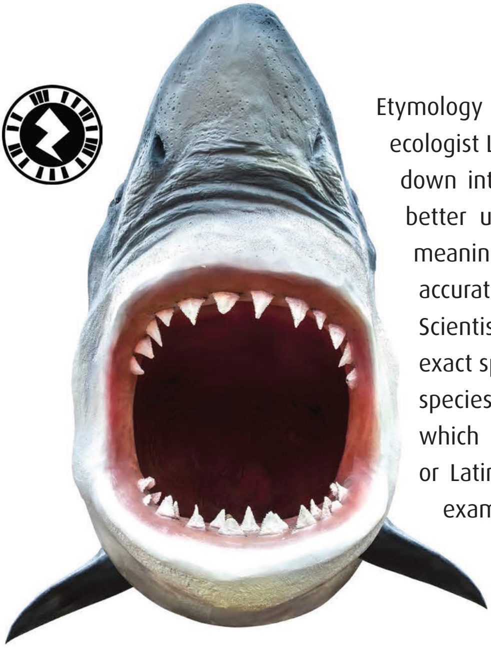
BLACKTIP REEF SHARK
(Carcharhinus melanopterus)
karcharos = sharp
rhinos = nose
melas = black
pteron = wing
Meaning:
SHARP NOSE BLACK WING!



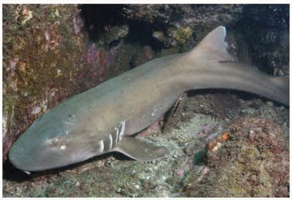
HORN SHARK
(Heterodontus francisci)
hetero= different
dont= teeth
francisci= San Francisco
Meaning:
SAN FRANCISCO DIFFERENT TEETH!

FUN FACT

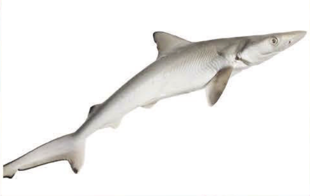
The characteristic “beard” and colouration of **Tasselled Wobbegong** allow it to camouflage into coral reefs. It then lies in wait to ambush prey that comes along.



Etymology is the study of word origins. Marine ecologist Leo Chan Gaskins enjoys breaking a name down into the components of the Latin word to better understand its meaning. Sometimes the meanings are spot on, describing the shark accurately. Sometimes they can be a bit silly. Scientists use Latin names to specify which exact species they are speaking about and every species has a two-word unique Latin name, which is usually italicized and based on Greek or Latin root words. A well-known Latin name example is *Tyrannosaurus rex*, meaning tyrant lizard king. Here are some fun examples of how marine scientists name sharks.



BROWNBANDED BAMBOO SHARK
(Chiloscyllium puntatum)
chilios= lip
skylla = shark
punctatus= punctuated (referring to stripes)
Meaning:
PUNCTUATED LIP SHARK!



SPINY DOGFISH SHARK
(Squalus acanthias)
squalus = a kind of sea-fish
acanthias = a prickly thing
Meaning:
A PRICKLY SEA-FISH THING!

BASKING SHARK
(Cetorhinus maximus)
Keto = sea monster/large fish
rhinos = nose
maximus = greatest
Meaning:
GREATEST NOSE SEA MONSTER!

FUN FACT

Spiny Dogfish sharks are named for the venomous spines in front of their dorsal (top) fins. These spines are toxic but not strong enough to kill a person.

GREAT WHITE SHARK
(Carcharodon carcharias)
karcharos = sharp
odus= teeth

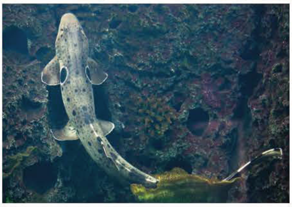
Meaning:
SHARP TEETH SHARP!

COMMON THRESHER SHARK
(Alopias vulpinus)
alopex= fox
vulpinus= fox
(hence Vulpix, the Pokémon!)

Meaning:
FOX FOX!

SANDBAR SHARK
(Carcharhinus plumbeus)
karcharos= sharp
rhinos = nose
plumbeus = of lead

Meaning:
SHARP NOSE OF LEAD!



EPAULETTE SHARK
(Hemiscyllium ocellatum)
hemi = half
skylla = shark
ocellus = little eye
(reference to spot)

Meaning:
LITTLE EYE HALF SHARK!

FUN FACT

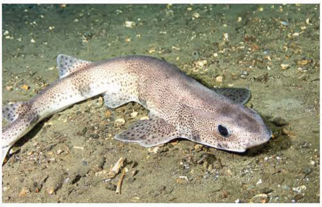
A **thresher shark** uses its long tail as an underwater whip to stun prey. They are also known as fox sharks!

FUN FACT

Epaulette sharks have evolved the ability to walk using their pectoral (side) fins! They can briefly venture out of the water to access different tide pools for food.

WATCH THIS:

Use your Zappar app to learn more with TED-Ed's video: *Why Sharks Are So Awesome*



SMALL-SPOTTED CATSHARK
(Scyliorhinus canicula)
skylla = shark
rhinos= nose
canis= dog

Meaning:
NOSE SHARK DOG!

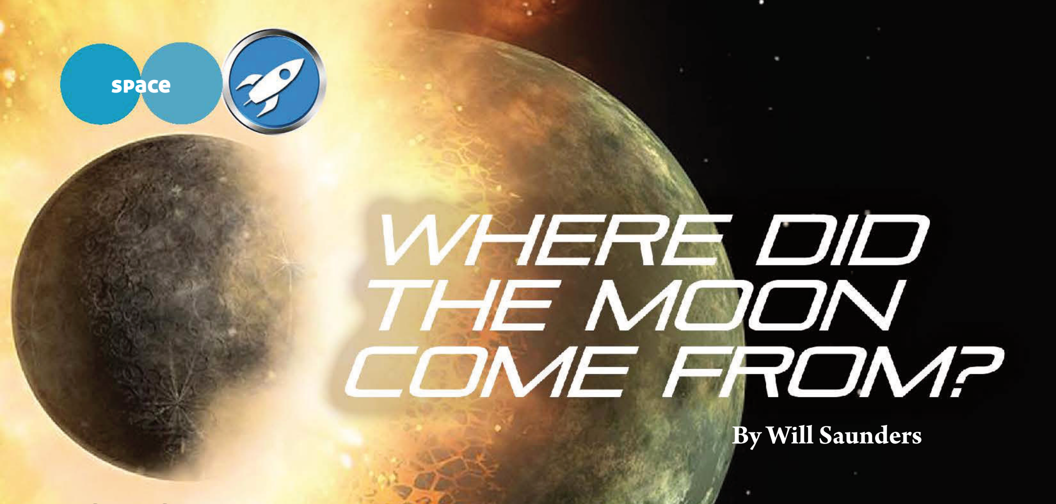
SHORTFIN MAKO SHARK
(Isurus oxyrinchus)
Isurus = same tail
oxy = sharp
rhynchus = beak

Meaning:
SAME TAIL SHARP BEAK!

ABOUT THE AUTHOR:
Leo Chan Gaskins (pronouns he/him) is a proud transgender and Asian-American marine ecologist. He studies how large animals impact the habitats in which they live and, specifically, he often works with sharks and rays to better understand their ecology and improve their conservation and management.

FUN FACT

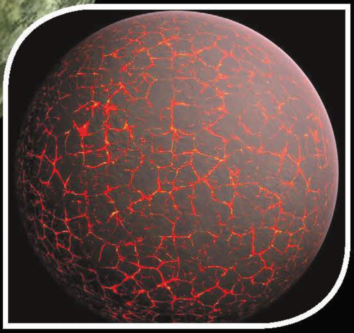
Mako sharks are the fastest sharks on Earth, reaching speeds of up to 74 km/h (45 mph)! The world's fastest swimmer, Caeleb Dressel, can swim up to 9 km/h (5.6 mph).



WHERE DID THE MOON COME FROM?

By Will Saunders

SMASH! THEIA LEAVES ITS MARK ON THE EARLY EARTH WITH A MASSIVE COLLISION.



Artist's conception of a young Earth

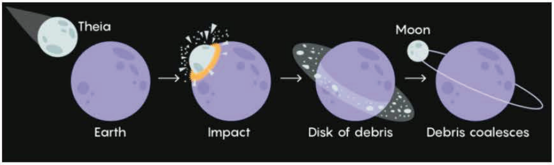
When the Earth was young, it was a hot mess. The ground was molten lava and volcanic eruptions filled the air with poisonous gases such as hydrogen sulfide, methane and carbon dioxide. The air was so thick that it acted like a blanket, raising the temperature to 230°C (446°F) and completely blocking out the sun. Meteors, small and large, rained down constantly from space, splashing up lava and depositing hot metals onto the Earth.

One of these meteors, called Theia, was unusually large. It was about the size of Mars, on a fateful collision course with young Earth. When it smashed into the Earth, it knocked a huge chunk of our planet right into space. But Theia didn't leave a crater because the Earth was still half-molten, and the lava flowed in to fill the hole.

All the rocks that Theia knocked into space began to orbit the Earth in a disk. For a while, Earth had rings like Saturn. It sure would have been a cool sight to see, but no life existed to see it. The rings didn't last very long. They mushed together like a rolling snowball to produce a big ball of rock. That's what we call the Moon.

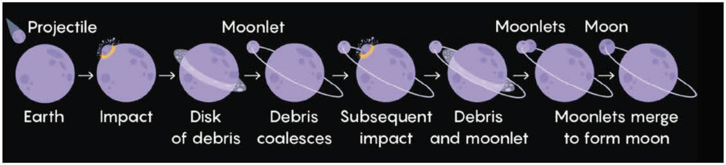
This story of moon formation is named the Giant Impact Hypothesis. It's called a "hypothesis" because it's only the best idea we have so far. Scientists always use data to question a hypothesis. As new data comes along, scientists upgrade the hypothesis to a better one.

The 4 steps of the Giant Impact Hypothesis:



Source: Lucy Reading-Ikkanda/Quanta Magazine

Multiple Impact Hypothesis:


Projectile
Moonlet
Moonlets
Moon
Earth
Impact
Disk of debris
Debris coalesces
Subsequent impact
Debris and moonlet
Moonlets merge to form moon

Source: Lucy Reading-Ikkanda/Quanta Magazine

Just like upgrading an app on your phone, an upgraded hypothesis works better and has new features.

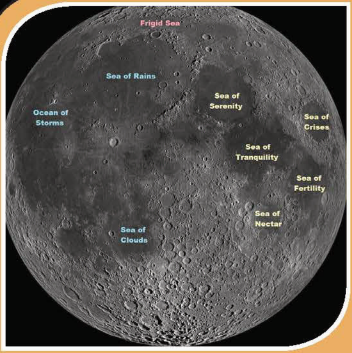
Scientists were recently working on an upgrade to the Giant Impact Hypothesis. Back when the hypothesis was first created, computers weren't very powerful. They could barely do 1st grade math! But now computers are so smart, they can solve the hardest math equations in the blink of an eye. Scientists have programmed these supercomputers to see what would happen after Theia hit the Earth. They were expecting to make a small upgrade, but the supercomputers said they needed a big upgrade instead.

These smart supercomputers found that one impact isn't enough to create the Moon – even if it's an enormous impact. So, astronomers created the Multiple Impact Hypothesis. Now it says there were several medium-sized asteroid crashes instead of one gigantic crash. Each medium crash produced a baby moon (or moonlet). Then the moonlets clumped together in the same snowball technique to form our Moon.

Is this the final upgrade? No way! As we learn more about the Moon and the planets, astronomers will create another, better hypothesis. By questioning the world around us, scientists continue to get closer and closer to understanding how things work. The more we keep asking "why?" and "how?" the closer we get to even better upgrades.

MOON FACTS!

1. The same side of the Moon always faces the Earth. Before there were spacecraft, we had no idea what the other side looked like!
2. The impacts that formed the Moon caused Earth to rotate faster. A day was only 5 hours long!
3. The Moon is moving away from the Earth. But don't worry, it only drifts away 4 cm (1.6 in) per year.

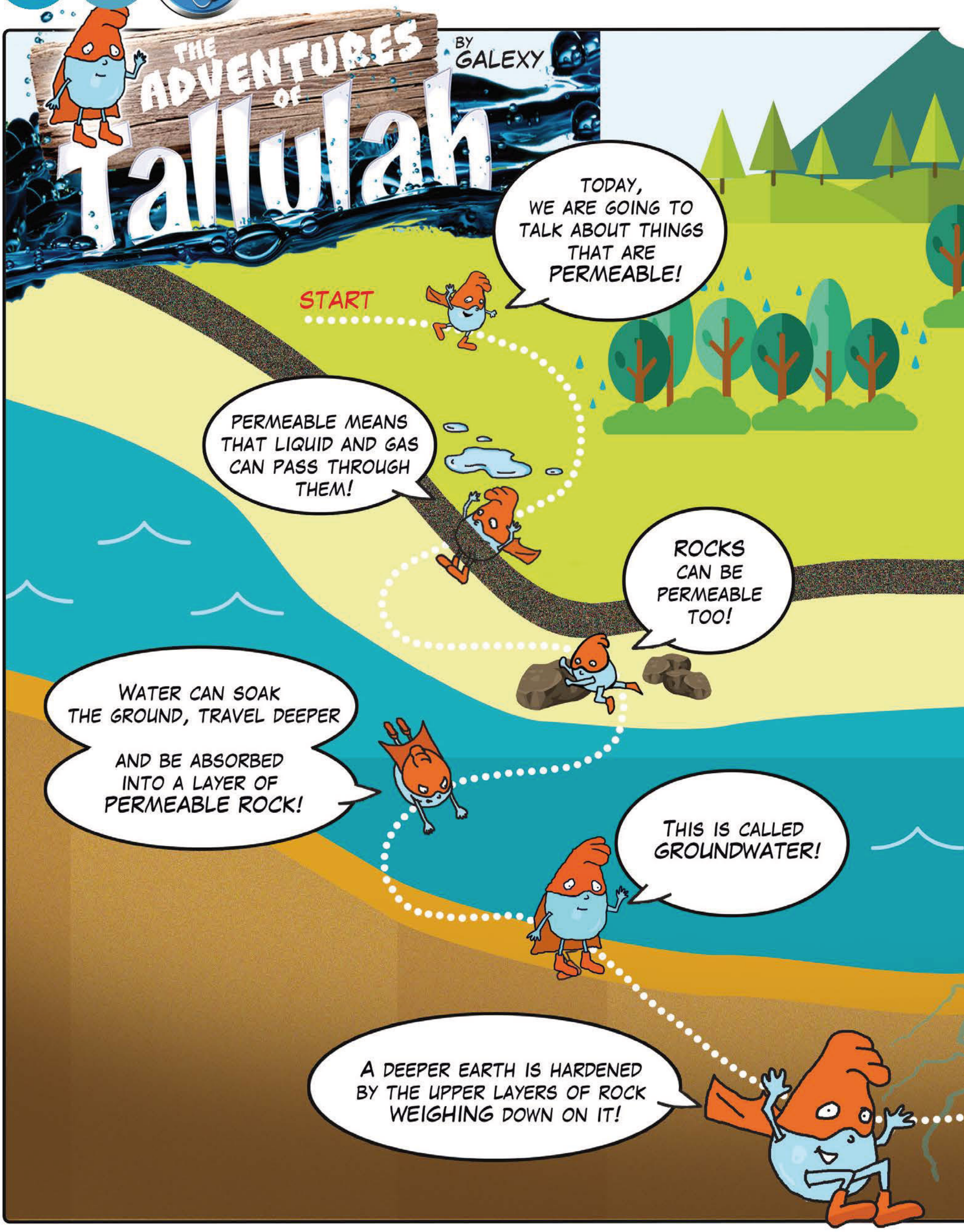

Frigid Sea
Sea of Rains
Sea of Serenity
Ocean of Storms
Sea of Crises
Sea of Tranquility
Sea of Fertility
Sea of Nectar
Sea of Clouds

The seas on the near side of the Moon that you can see at night.

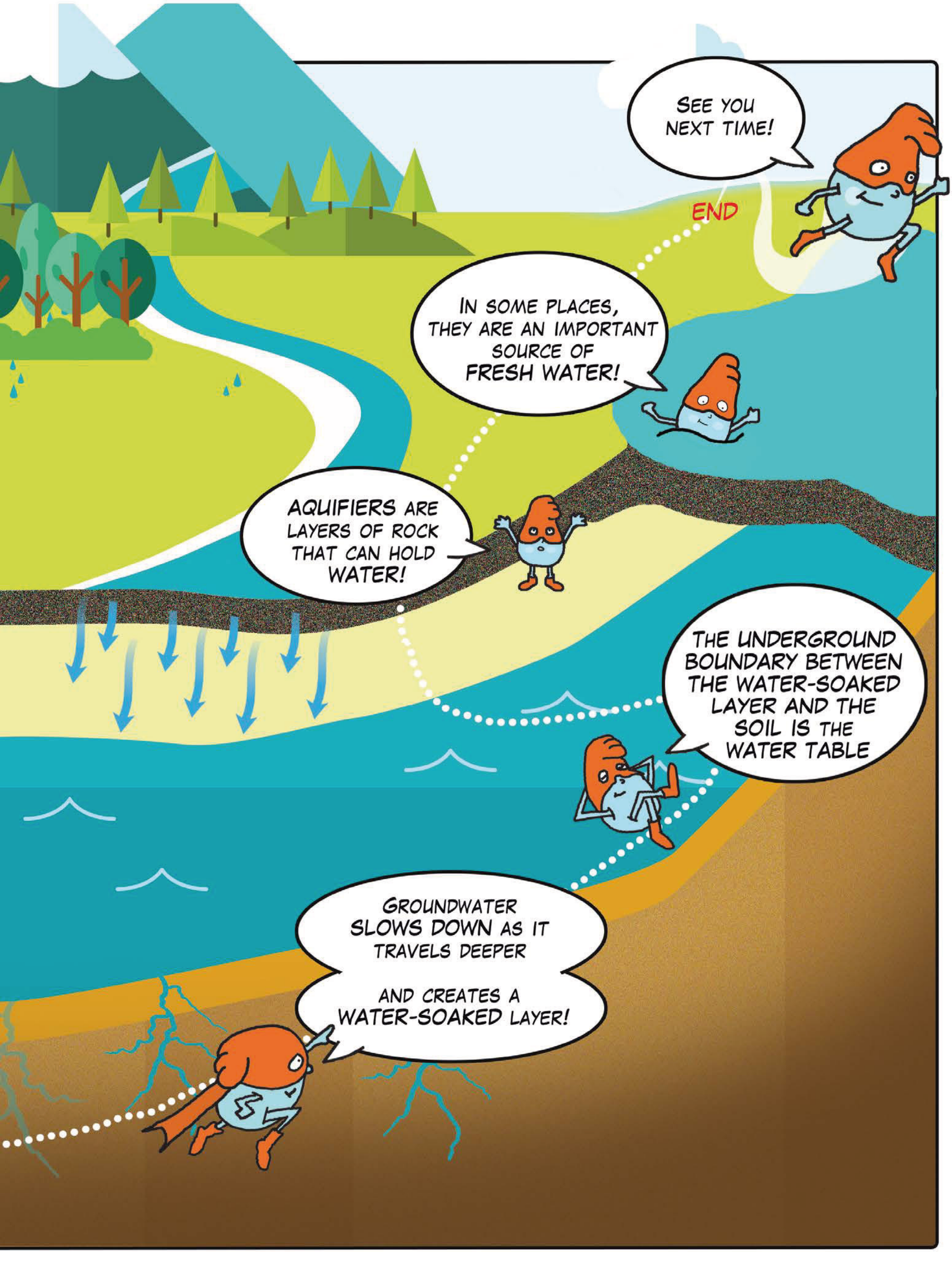
UP CLOSE AND PERSONAL WITH THE MOON

How closely have you looked at the Moon? Ever wondered what all those dark spots are? Well, grab a pair of binoculars and go look up! Each dark area is called a sea but you can't swim in them. When the Moon first formed, it had tons of volcanoes. They erupted, creating seas of lava that eventually hardened into the dark rocks we see today.

What's the biggest crater you can find? Each crater formed when the Moon was hit by a meteor a long time ago. The Earth was hit by lots of meteors too, but you don't see craters on Earth. Why? Because plants, animals, oceans, and earthquakes erase craters on Earth. But on the Moon, there's nothing to erase the craters. They stick around forever.


THE ADVENTURES OF Tallulah
BY GALEXY
TODAY, WE ARE GOING TO TALK ABOUT THINGS THAT ARE PERMEABLE!
START
PERMEABLE MEANS THAT LIQUID AND GAS CAN PASS THROUGH THEM!
ROCKS CAN BE PERMEABLE TOO!
WATER CAN SOAK THE GROUND, TRAVEL DEEPER
AND BE ABSORBED INTO A LAYER OF PERMEABLE ROCK!
THIS IS CALLED GROUNDWATER!
A DEEPER EARTH IS HARDENED BY THE UPPER LAYERS OF ROCK WEIGHING DOWN ON IT!

MORE TALLULAH For more of Tallulah's adventures visit our site for information on our new book packed with all of her stories.


SEE YOU NEXT TIME!
END
IN SOME PLACES, THEY ARE AN IMPORTANT SOURCE OF FRESH WATER!
AQUIFIERS ARE LAYERS OF ROCK THAT CAN HOLD WATER!
THE UNDERGROUND BOUNDARY BETWEEN THE WATER-SOAKED LAYER AND THE SOIL IS THE WATER TABLE
GROUNDWATER SLOWS DOWN AS IT TRAVELS DEEPER

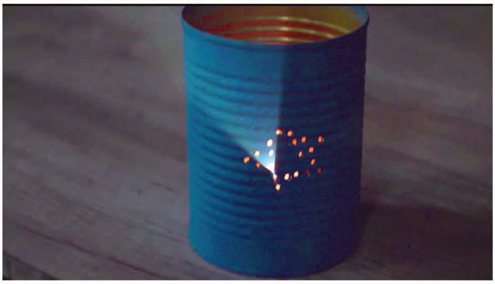
AND CREATES A WATER-SOAKED LAYER!

Download *Tallulah's Adventures* by visiting
brainspacemagazine.com/Tallulah

SUSTAINABLE GIFTS

Upcycling is the process of reusing or repurposing materials you no longer need or want into something amazing! Upcycled crafts reduce waste, are a lot of fun, and can be gifted to people you love.

by Jessica Rose



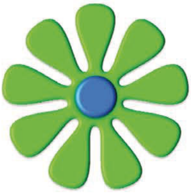
WIND CHIMES

TIN CAN LANTERNS

This DIY activity is sure to light up any mom or dad's life. All you'll need is a washed tin can of any size, a piece of paper, tape, hammer and a nail. Draw a pattern onto a piece of paper using a series of dots. Tape the paper to the can, then use the hammer and nail to puncture holes where you've drawn the dots. If you want to add an extra step, paint your can a bright colour before you start. Your lantern will brighten up any balcony or backyard when you place a candle inside.

WIND CHIMES

You'd be amazed at how many household items make pretty sounds. String together cutlery, tin cans, keys or other discarded metal objects to make a wind chime. For a different sound, you could also use shells. Hang the items you choose from a stick you find in nature, a piece of wood you no longer need or a wire coat hanger.



SCAN THIS TV SCREEN TO WATCH HOW TO MAKE EACH OF THESE CRAFTS

Alex Middleton

TINY GARDENS

Take a look around your house for materials that could be transformed into tiny flower pots. We suggest an empty baby food jar, a mini mason jar, or a yogurt cup. Each is the perfect size for a little soil plus a vegetable or herb seedling. Place it in a sunny spot and don't forget to water it. Once it grows big enough, this thoughtful gift can be replanted into a garden. Decorate your tiny flower pot with stickers or paint, and don’t forget to tie it with a ribbon! You can also use chalkboard paint to create a label. Use chalk to write the name of the plant.

FRIDGE MAGNETS

Magnets are one of the simplest upcycled crafts and can also be very useful if you’re putting your report card or a drawing on the fridge. Paint a bottle cap and add sparkles, googly eyes or decoupage to create your own designs. Use a glue gun to attach a magnet.

IMPORTANT TIP: Make sure you wash any materials you’re upcycling thoroughly, especially if they once contained food. And before you start digging through your parents’ cutlery drawer, make sure that all the materials you’re using are, in fact, items that are no longer needed or wanted.

Brainspace

Gift a subscription to a bright child today!

- visit online brainspacemagazine.com
- call Toll-free (844) 330-4314
- or complete and mail in the form below.

OR SCAN THIS CODE TO SUBSCRIBE ONLINE!
USE CODE AG16 FOR A 15% DISCOUNT
(ONLINE OFFER ONLY)

CANADIAN ADDRESS: ☐ **$40.00 (1-YEAR)**

US ADDRESS: ☐ **$55.00** (1-YEAR)

INTERNATIONAL ADDRESS: ☐ **$90** (1-YEAR)

ADD-ONS

☐ **1 back issue + $5.00**

☐ **3 back issues + $20.00**

TOTAL ____________________

SUBSCRIPTION START

☐ immediately ☐ FEB ☐ APR ☐ JUN ☐ AUG ☐ OCT ☐ DEC

YOUR PAYMENT INFORMATION:

☐ CHEQUE (PAYABLE TO BRAINSPACE PUBLISHING INC.) OR
☐ VISA OR ☐ MASTERCARD

CARD NUMBER: ____________________

DATE OF EXPIRY ____________________ 3-digit CCV __________

NAME ____________________

SIGNATURE ____________________

POSTAL CODE: ____________________

YOUR EMAIL ADDRESS FOR CONFIRMATION RECEIPT

____

WHO ARE WE SENDING THIS NEW SUBSCRIPTION TO?

NAME: ____________________

STREET: ____________________

CITY/TOWN: ____________________

PROVINCE: ____________________

COUNTRY ____________________

POSTAL/ZIP ____________________

MAIL THIS FORM WITH PAYMENT TO
Brainspace Publishing Inc.
394 Ontario Street,
Newmarket ONTARIO
L3Y 2K4